moved over Lakes Erie and Huron, and it disappeared to the northward on the 26th.

X.—This area of low pressure was central in Utah on the afternoon of the 25th, and moved southeastward to northern Texas, where it was central on the morning of the 26th. It moved northeastward from this position with decreasing pressure at the centre until it reached the Mississippi Valley, and it was attended by heavy rains generally throughout the Northern States, lower Mississippi valley, and west Gulf states. It remained almost stationary in the upper Mississippi valley during the 27th, after which it extended northeastward and moved rapidly over the Lake region to the Saint Lawrence Valley. The minimum pressure, 29.42, was observed while this area was central near Keokuk, Iowa, on the afternoon of the 27th. This condition was followed by a slight increase of pressure at the centre during the easterly movement until the storm had passed over the Lake region, after which the pressure at the centre fell again to 29.42, accompanied by strong westerly gales in the lower lake region. The disturbance disappeared to the northeast on the 30th.

NORTH ATLANTIC STORMS FOR MAY, 1888.

[*Pressure in inches and millimetres; wind-force by Beaufort scale.*]

The paths of the depressions that appeared over the north Atlantic Ocean during May, 1888, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the cooperation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Eleven depressions have been traced, of which six advanced eastward over northern Newfoundland; three first appeared over mid-ocean; one apparently developed west of theBritish Isles; and one moved northwestward from the Caribbean Sea into the Gulf of Mexico. The general direction of movement of the depressions was east-northeast, although, in instances, marked irregularities in their advance was shown. One depression traversed the ocean from coast to coast. The month opened with unsettled and stormy weather over the entire ocean. The depression central over Ireland April 30th had moved northeasterly over Scotland, attended by barometric pressure falling below 29.00 (736.6); a storm of great energy was central over mid-ocean, while off the American coast, in the vicinity of the fortieth parallel, a disturbance of moderate strength appeared. From the 2d to the 6th there was an apparent transition of high barometric pressure from the Azores to the British Isles, during which period a depression moved northeastward from south of Nova Scotia and disappeared in the direction of Iceland. From the 6th to the 10th high barometric pressure and fair weather prevailed over the eastern portion of the ocean, while in the vicinity of Newfoundland the passage of two depressions of small energy occasioned moderate to fresh gales. During the last half of the second decade of the month stormy weather prevailed over the British Isles, attending the irregular movements of a depression to the westward; to the westward of the fortieth meridian the weather was changeable, with frequent and marked barometric fluctuations. During the third decade the barometer continued high east of the thirtieth meridian until the 26th, from which date until the 30th, inclusive, stormy weather prevailed in that region. From the 21st to the 24th a storm of pronounced energy moved eastward over the Banks of Newfoundland from the Gulf of Mexico, and thence passed northward toward Greenland. The latter portion of the month was chiefly characterized by the passage of a depression from the Gulf of Mexico to the British Isles. The storm which is given a probable track from the Caribbean Sea into the Gulf of Mexico from the 9th to the 11th, while unimportant as regards strength, would seem to indicate the development of meteorological conditions in the tropical north Atlantic favorable for the summer cyclones peculiar to that region.

In May, 1887, eleven depressions were traced, of which two traversed the ocean from coast to coast; one originated over the Caribbean Sea and moved northward over Cuba; one first appeared south of Bermuda and advanced northward; one passed eastward from the American coast in about N. 41° and subsequently moved northward; four developed to the southward or southeastward of Nova Scotia or Newfoundland; one was first charted northeast of Newfoundland; and two appeared within the region of observation in European waters, one having advanced from the southwest and the other from the northwest. The general direction of movement of the depressions was east-northeast to the eastward of the fortieth meridian, while to the westward of that longitude the tracks were greatly diversified as regards position and direction. The general character of the weather over the ocean was seasonable, and the depressions which appeared corresponded closely with the average for the month as regards position, number, and direction of movement. The severest disturbances prevailed over mid-ocean from the 22d to the 25th, inclusive.

The depressions of May, 1888, were of about normal intensity, and in distribution, number, and direction of movement, corresponded with the average for the month.

In the following descriptions of the depressions traced, positions are given in degrees, latitude and longitude, except in cases where twenty-five to thirty-five minutes are cited, when they are shown in degrees and half degrees:

1.—This depression was central on the 1st in about N. 52°, W. 27°, with barometric minimum about 29.20 (741.7), whence it advanced to N. 57°, W. 17°, by the 2d, after which it passed to the north of the British Isles, with fresh to strong gales.

2.—This depression occupied the ocean off the American coast in the vicinity of the forty-first parallel on the 1st, whence it moved east-northeast to the sixtieth meridian by the 2d, in which locality it remained nearly stationary until the 3d; by the 4th the storm-centre had passed northward to Newfoundland, subsequent to which date it recurved south of east and then advanced rapidly northeastward and disappeared in the direction of Iceland after the 6th. This storm developed marked energy while traversing Newfoundland and the Grand Banks, where barometric pressure falling below 29.60 (751.8) was shown.

3.—This was a depression of moderate energy which passed eastward from the Gulf of Saint Lawrence during the 7th, and on the 8th was central northeast of Newfoundland, from which position the storm-centre moved northeast and disappeared north of the region of observation after the 9th.

4.—The presence of this depression over or near the western portion of Cuba was indicated by reports of the 9th, to which locality it had apparently advanced from the Caribbean Sea; by the 10th the centre of depression had moved westward, and its approximated position on that date was to the northward of Yucatan; by the 11th the storm-centre had passed to the westward of the ninetieth meridian, after which its course cannot be determined by reports at hand. The limited data received from the region through which this disturbance passed, while indicating its small strength and probable track, will not admit of a more accurate definition of its characteristics.

5.—This depression passed southeast from the Gulf of Saint Lawrence during the 9th and on the morning of the 10th was central southeast of Newfoundland, with barometric pressure about 29.60 (751.8); by the 11th the centre of disturbance had moved northeast to N. 50°, W. 41°, with a marked decrease in central pressure. On this and the following date an area of high barometric pressure occupied the ocean east of the thirtieth meridian and had the apparent effect of deflecting the

depression westward, and a recurve of its path to N. 48°, W. 43°, is shown on the chart, in which position a marked loss of energy was apparent. Subsequent to the 12th the storm dissipated.

6.—This depression passed eastward from the American coast in the vicinity of the forty-first parallel on the 13th, and by the 14th had advanced to the sixty-fifth meridian. Under the apparent influence of an area of high barometric pressure which moved southeastward over Newfoundland from the 14th to the 16th the depression recurved to the northwestward by the 15th and remained nearly stationary south of Nova Scotia during that and the following date; by the 17th the storm had moved to the western part of Newfoundland, whence it passed south of east over the Grand Banks and thence advanced rapidly east-northeast to N. 51°, W. 27°, by the 20th, attended by fresh and strong increasing to whole gales. On the 20th the barometric pressure was high over the British Isles, and the depression recurved westward to N. 52°, W. 31°, with central pressure falling below 29.00 (736.6); by the 22d the storm had moved southwest and united with depression number 8 to the eastward of the Banks of Newfoundland.

7.—This was a depression of considerable energy which remained nearly stationary between the twentieth meridian and the Irish coast from the 15th to the 19th, inclusive, after which it apparently recurved to the southwestward and united with depression number 6. During the 16th, 17th, and 18th, fresh to strong gales and barometric pressure ranging from 29.10 (739.1) to 29.20 (741.7) were reported off the west coast of Ireland.

8.—This depression passed southeastward over the Gulf of Saint Lawrence during the 20th, and on the morning of the 21st was central east of Cape Breton Island, where small energy was shown; by the 22d the centre of disturbance had moved eastward to the forty-fifth meridian, attended by strong to whole gales and barometric pressure falling to about 29.10 (739.1). During the next two days the disturbance advanced northward without evidence of diminished energy, and disappeared north of the fifty-fifth parallel, its northerly curve being evidently due to the presence over the eastern portion of the ocean of an area of high barometer.

9.—This depression was central on the 20th over the eastern portion of the Gulf of Mexico, whence it moved slowly northeastward over Florida and off the coast to the fortieth parallel by the 25th, its passage being attended over the eastern part of the United States and the adjacent ocean by continuous rains. By the 26th the centre of disturbance had passed south of east to N. 38°, W. 62°, after which it pursued a normal east-northeast course to the British Isles by the 30th, accompanied during the 27th, 28th, and 29th, by barometric readings ranging from 29.10 (739.1) to 29.50 (749.3), and fresh to strong gales. This storm was probably of tropical origin, and in its slow progressive movement along the American coast presented the relatively high cyclonic barometric pressure, yet widespread influence which occasionally characterize storms which advance northward from the West Indies.

10.—This depression first appeared over mid-ocean north of the Azores on the 25th, and thence passed eastward to the southward of the British Isles by the 28th, without evidence of marked energy; subsequent to the 28th the centre of disturbance apparently recurved northwest and united with depression number 9.

11.—This depression probably developed off the southeast edge of the Banks of Newfoundland during the 29th; at noon, Greenwich time, of the 30th the storm was central in N. 40°, W. 38°, from which position it advanced northeast to the forty-fifth parallel by the 31st, with fresh to whole gales and barometric pressure falling to about 29.50 (749.3).

OCEAN ICE.

On chart i the positions of icebergs and field ice are shown by ruled shading. Ice and field ice were reported during the month as follows:

1st.—S. S. "Fremona," 55 miles east from Saint John's, field of ice interspersed with bergs.

2d.—S. S. "Fremona," from Cape Race to Saint Pierre Island, several large bergs.

4th.—S. S. "Baumwall," N. 47° 55′, W. 50° 10′, small icebergs. S. S. "Boston City," from Cape Saint Francis to Cape Race, solid field ice and huge bergs; drift ice between Cape Race and Cape Pine.

5th.—S. S. "Baumwall," from Ferryland to Cape Race, many large and small bergs; heavy pack ice in shore. S. S. "Lake Ontario," N. 46° 48′, W. 52° 40′, bergs and field ice.

6th.—S. S. "Colina," ten miles south by east from Cape Race, heavy field ice and small bergs.

10th.—S. S. "Damara," N. 46° 40′, W. 52° 05′, field ice and bergs. "S. S. "Peruvian," N. 46° 16′, W. 52° 46′, closely packed field ice and several bergs; off Cape Spear, became completely blocked with field ice and bergs. S. S. "Glendale," N. 45° 56′, W. 59° 39′, fields of ice.

11th.—S. S. "Sarnia," N. 48° 05′, W. 48° 55′ and N. 47° 51′, W. 49° 39′, icebergs.

12th.—S. S. "Sarnia," N. 46° 47′, W. 54° 26′, one large berg, and southeast of Cape Race to Cape Pine, field and pack ice. S. S. "Peruvian," from Saint John's, N. F., to within 56 miles of Cape Race, considerable quantities of field ice and bergs.

13th.—S. S. "Nubia," N. 44°, 00′, W. 48° 10′, several large bergs, and N. 42° 00′, W. 51° 00′, one large berg.

14th.—S. S. "Vandyck," N. 41° 00′, W. 46° 00′, icebergs; Low Point, C. B., heavy open ice in shore.

15th.—S. S. "Aline," N. 46° 00′ W. 51° 00′, to N. 46° 06′, W 53° 00′, a number of immense bergs.

17th.—S. S. "Lake Superior," N. 46° 21′, W. 53° 45′, several bergs and pieces. S. S. "Oregon," N. 47° 31′, W. 51° 05′, one large berg.

18th.—S. S. "Oregon," N. 46° 18′, W. 53° 46′ to N. 46° 20′, W. 54° 44′, huge bergs and several small ones. S. S. "Montana," N. 46° 20′, W. 54° 44′, several icebergs.

19th.—S. S. "Coventry," N. 47° 10′, W. 62° 35′, large detached pieces of ice. S. S. "Oregon," N. 46° 20′, W. 53° 46′ to N. 46° 18′, W. 54° 44′, several large bergs and lumps.

20th.—S. S. "Colina," 25 miles south of Cape Saint Mary, N. F., an immense field of ice and numerous bergs. S. S. "Holstein," N. 45° 52′, W. 54° 32′, one berg. S. S. "Portia," coast from Saint John's to Cape Race blocked with ice 14th to 20th.

21st.—S. S. "Coventry," N. 47° 10′, W. 62°, 59′, entered heavy packed ice and remained fast until the 26th. S. S. "Holstein," off Heath Point, Anticosti, several small bergs.

22d.—S. S. "Pomeranian," N. 46° 01′, W. 54° 08′ to N. 46° 10′, W. 54° 54′, small detached bergs; s. s. "Caspian," N. 47° 39′, W. 51° 00′, one large berg.

23d.—S. S. "Caspian," 30 miles west from Cape Race, thirty bergs.

24th.—S. S. "Caspian," 80 miles west from Cape Race, one very large berg.

26th.—S. S. "Corean," N. 45° 44′, W. 53° 43′, one large berg; s. s. "Dominion," Cape Race bearing S. 62° W., 20 miles, passed about fifty bergs to Cape Race.

27th.—S. S. "Corean," N. 45° 59′, W. 54° 40′, large berg.

28th.—S. S. "Lake Nepigon," Cape Race to Cape St. Mary, passed several bergs.

30th.—S. S. Wylo, 40 miles south from Cape Race, several large bergs; s. s. "Palino," numerous icebergs on the south and east coasts of Newfoundland.

31st.—S. S. "Vancouver," off Cape Race, two bergs.

As compared with the ice record for the preceding month, there has been a marked increase in the aggregate quantity of ice reported off the east and south coasts of Newfoundland and in the Gulf of Saint Lawrence, while the positions of detached ice fields and bergs remain materially the same.

Compared with the record of corresponding months of previous years, the reports for May, 1888, show that ice was observed somewhat to the southward of the average southern

limit and from one to two degrees west of the average eastern limit. Reports would also indicate that more than the usual amount of damage to shipping was caused by encounters with icebergs and heavy field ice, and that vessels were more frequently blocked or detained by ice massed off the Newfoundland coasts or in the Gulf of Saint Lawrence.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for May during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
	° ′	° ′		° ′	° ′
May, 1883	40 30	47 00	May, 1883	45 40	45 12
May, 1884	41 30	47 30	May, 1884	43 30	44 50
May, 1885	40 50	48 15	May, 1885	42 30	40 10
May, 1886	41 36	51 30	May, 1886	48 55	46 13
May, 1887	39 38	46 00	May, 1887	39 38	46 00
May, 1888	41 00	46 00	May, 1888	41 00	46 00

FOG.

The limits of fog-belts to the westward of the fortieth meridian are shown on chart i by dotted shading. As compared with the chart for April, 1888, a slight extension of the southern limit of the Newfoundland fog-belt is shown, and the number of days during which fog prevailed in that region, seventeen, was five less than the aggregate number of foggy days reported for the preceding month. To the westward of the sixtieth meridian fog was reported for a total of twenty-seven days during May, while in April the foggy days numbered but fourteen. For the dates during which fog was reported over or near the Banks of Newfoundland, its development invariably attended the approach and passage of areas of low barometric pressure, while to the southward of Nova Scotia and along the American coast its presence, as a rule, accompanied the disturbed atmospheric conditions attendant upon the advance from the westward or southwestward of cyclonic areas.

The unusual prevalence of fog to the westward of the sixtieth meridian constitutes a noteworthy feature of May, 1888, and would seem to indicate abnormally large differences between the temperature of the ocean and that of the air currents brought into contact therewith.

The following are the limits of fog-areas on the north Atlantic Ocean during May, 1888, as reported by shipmasters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
		° ′	° ′		° ′	° ′	
1	S. S. Waesland	40 23	67 15	3.40 p. m.	40 23	68 03	6.45 p. m.
1	Edith Godden	39 30	74 02	11.25 a. m.	Sandy	Hook.	
1	Nessmore	39 53	51 20	2.30 p. m.	39 54	49 55	4.40 p. m.
1	Lahn	42 14	50 48	7 p. m	42 07	52 12	10.50 p. m.
1-2	City of Berlin	41 35	45 16	8.59 p. m.	40 24	51 20	8.35 a. m.
2	Gallia	40 54	61 49	10 a. m.	40 51	63 08	2 p. m.
2-3	Slavonia	45 30	46 35	9 p. m.	43 34	51 24	5 p. m.
3	Buffalo	42 23	46 25	2 p. m	42 15	46 38	4 p. m.
3-4	Baumwall	49 16	43 40	3 p. m	48 00	49 50	6.30 p. m.
4	State of Nebraska	47 18	42 50		46 18	45 07	
4	Ems	43 35	48 24	6.30 a. m.	43 26	49 24	7.30 a. m.
4-5	Lake Ontario	50 08	43 34	9 a. m.	46 48	52 40	8.29 a. m.
5-6	Exeter City	41 03	66 30		40 11	71 50	
6	Pavonia	42 30	64 29	5 a. m	42 26	68 31	Midnight.
6-7	Aurania	Sandy	Hook.	9 p. m	41 00	59 18	4 p. m.
7	Siberian	42 29	56 44	4 a. m	42 30	54 45	Noon.
7	Devonia	41 35	60 18	1 a. m	41 13	63 26	2.13 p. m.
7-8	Rhein	37 34	73 26	8 p. m	Cape	Henry.	8 a. m.
7-8	Brooklyn City	42 50	51 00	7 p. m	43 25	48 40	7 a. m.
8	Stockholm City	44 15	45 20	5 a. m.	44 20	49 20	9.15 a. m.
9-10	Mareca	43 25	63 47	8 p. m	42 32	68 25	8.30 p. m.
9-11	Celtic	44 25	57 56	11 p. m	40 34	71 41	6 a. m.
11	Servia	41 23	61 46	2.05 p. m.	41 15	63 16	6 p. m.
11	Aller	41 15	65 03	9.40 a. m.	40 30	72 42	3.50 p. m.
11-12	Island	40 50	64 55	4 a. m	40 40	73 00	1 p.m.
12-13	Mentmore	39 22	69 30	3 p.m.	38 10	72 50	11 a. m.
13	Cyprus	36 20	74 50	7 a. m.	36 44	74 53	9.30 a. m.
13-14	Etruria	40 30	71 56	6.48 p. m.	40 30	63 39	10.15 a. m.
14-15	Scythia	43 32	48 05	8.52 p. m.	41 54	52 55	1.27 p. m.
15	Germanic	44 00	48 00	3 a. m.	43 30	51 10	11.30 a. m.
15	England	40 50	67 30	11.50 a. m.	40 41	68 05	4.30 p. m.
16	Rugia	41 48	59 10	4.30 p. m.	41 46	59 26	5.30 p. m.
17	Cephalonia	42 00	49 00	9.10 a. m.	42 00	50 00	Noon.
17	Norrona	43 16	65 23	3.45 p. m.	43 17	65 34	4.30 p. m.
18-19	Colima	48 24	62 14	10.55 p.m.	48 04	61 05	3.15 a. m.
18-19	State of Pennsylva-	47 40	47 03	3.10 p. m.	45 23	52 22	0.29 p. m.
19	Schiedam	40 39	69 03	4 a. m.	40 30	71 15	1 p. m.
20	Egypt	41 05	66 12	10.30 a. m.	40 53	67 42	4.30 p. m.
20	Victory	44 00	48 00		44 39	51 33	
23-24	Wyanoke	39 20	74 10	11.30 p. m.	37 00	75 55	2 p. m.
24	Bothnia	42 45	49 59	10 a. m.	42 44	50 22	11 a. m.
25	Trave	40 41	70 10	2 a. m.	40 30	73 20	10 a. m.
26	Virginian	43 53	48 48	9 p. m.	43 43	49 25	11.30 p. m.
26	Berrita	37 30	74 20	7 a. m.	39 15	74 20	Midnight.
27	Ludgate Hill	40 00	70 00		Sandy	Hook.	
27	Virginian	42 41	53 31	2.45 p. m.	42 39	53 45	3.45 p. m.
28	Faedrelandet	35 54	74 39	4 p. m	37 20	74 46	11 p. m.
29	Ailsa	39 00	73 56	7 a. m.	39 25	74 00	10 a. m.
30	Lahn	41 05	63 10	11 a. m.	41 03	63 30	12.45 p. m.
31	La Gascogne	42 05	49 35	8.42 p. m.			
31	Gallia	40 46	65 28	1 a. m.	Scotland Lt.Sp.		2 p. m.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for May, 1888, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal, and subtracting when above.

On the north Pacific coast and in the middle and northern plateau districts the month was warmer than the average, the excess over the normal temperature being slight, except in Washington Territory and Oregon, where it ranged from 2° to 5°. In southern California, and in all districts east of the Rocky Mountains, the month was colder than the average. The deficiencies of temperature was very slight in the Southern States, but in the northern districts they were quite marked, amounting to from 6° to 9° from Dakota eastward to the Lake region. On the Atlantic coast the deficiencies ranged from less than 1° in the south Atlantic states to about 4° at stations on the southern New England coast.

The following are some of the most marked departures from normal temperatures at Signal Service stations:

Above normal.		Below normal.	
	°		°
Walla Walla, Wash	5.8	La Crosse, Wis	9.3
Portland, Oregon	5.3	Saint Paul, Minn	9.2
Astoria, Oregon	4.4	Yankton, Dak	7.7
Roseburg, Oregon	4.1	Des Moines, Iowa	7.5
Spokane Falls, Wash	3.8	Milwaukee, Wis	7.4
Olympia, Wash	3.4	Omaha, Nebr	7.1
Fort Canby, Wash	2.1	Marquette, Mich	6.8

At Signal Service stations the absolute maximum temperature for the month, 107°, occurred at Fort McDowell, Ariz., on the 12th; absolute minimum, 6°.7, occurred on the summit of Pike's Peak, Col., on the 3d, the next lowest being 14°.4 at Saint Vincent, Minn., on the 17th. The highest monthly mean temperature, 78°.6, is reported from Rio Grande City, Tex., and the lowest, 21°.3, from Pike's Peak, Col., the next lowest being 42°.2 from Duluth, Minn.

The table of comparative maximum and minimum temperatures shows that the maximum temperatures of May, 1888, have been exceeded in past years at all stations. The minimum temperatures, however, were the lowest that have yet occurred in May at some stations, viz., Block Island, R. I., Charlotte, N. C., Knoxville, Tenn., Marquette, Mich., and Saint Vincent,